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# Minimum Wages, Labor Market Institutions, and Female Employment: A Cross-Country Analysis

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Founded in 1963 by two prominent Austrians living in exile – the sociologist Paul F. Lazarsfeld and the economist Oskar Morgenstern – with the financial support from the Ford Foundation, the Austrian Federal Ministry of Education and the City of Vienna, the Institute for Advanced Studies (IHS) is the first institution for postgraduate education and research in economics and the social sciences in Austria. The **Economics Series** presents research done at the Department of Economics and Finance and aims to share “work in progress” in a timely way before formal publication. As usual, authors bear full responsibility for the content of their contributions.

Das Institut für Höhere Studien (IHS) wurde im Jahr 1963 von zwei prominenten Exilösterreichern – dem Soziologen Paul F. Lazarsfeld und dem Ökonomen Oskar Morgenstern – mit Hilfe der Ford-Stiftung, des Österreichischen Bundesministeriums für Unterricht und der Stadt Wien gegründet und ist somit die erste nachuniversitäre Lehr- und Forschungsstätte für die Sozial- und Wirtschaftswissenschaften in Österreich. Die **Reihe Ökonomie** bietet Einblick in die Forschungsarbeit der Abteilung für Ökonomie und Finanzwirtschaft und verfolgt das Ziel, abteilungsinterne Diskussionsbeiträge einer breiteren fachinternen Öffentlichkeit zugänglich zu machen. Die inhaltliche Verantwortung für die veröffentlichten Beiträge liegt bei den Autoren und Autorinnen.

## **Abstract**

The authors investigate the employment consequences of minimum wage regulation in 16 OECD countries, 1970-2008. Their treatment is motivated by Neumark and Wascher's (2004) seminal cross-country study. Apart from the longer time interval examined, a major departure is the authors' focus on prime-age females, a group often neglected in the minimum wage literature. Another is their deployment of time-varying policy and institutional regressors. The average effects they report are consistent with minimum wages causing material employment losses among the target group. Their secondary finding is that minimum wage increases are more associated with (reduced) participation rates than with elevated joblessness. Further, although the authors find common ground with Neumark and Wascher as regards the role of some individual labor market institutions and policies, they do not observe the same patterns in the institutional data. Specifically, prime-age females do not exhibit stronger employment losses in countries with the least regulated markets.

## **Keywords**

Minimum wages, minimum wage institutions, prime-age females, disemployment, participation, unemployment, employment protection, labor standards, labor market policies, unions

## **JEL Classification**

J20, J38, J48, J58, J88

### **Comments**

John T. Addison is Professor of Economics at University of South Carolina; Orgul Demet Ozturk is Assistant Professor of Economics at University of South Carolina. Sequential iterations of this paper were presented at the May 2011 Sixteenth Annual Meetings of the Society of Labor Economists in Vancouver, and seminars at the Institut für Höhere Studien (IHS) in Vienna, and the Institut für Arbeitsmarkt- und Berufsforschung (IAB) of the Bundesagentur für Arbeit (BA) in Nürnberg. The authors are indebted to participants for their insightful comments. In addition, they owe special thanks to David Neumark and William Wascher for supplying the data from their 2004 study, to Chris Ruhm for country data on parental leave, and to Per Skedinger for series on the ratio of the minimum wage to the average 1. Introduction age wage in various Swedish industries.



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## 1. Introduction

There is comparatively little *cross-country* evidence on the effects of minimum wages on employment. This contrasts with the truly enormous literature on minimum wages. What evidence we have is contained in just two main empirical inquiries: an early study by the Organisation for Economic Co-operation and Development (OECD, 1998) looking at the effect of minimum wages on the employment-to-population ratio of both teenagers and young persons (as well as adults) for a sample of between 7 and 9 OECD countries, 1975-1996, and Neumark and Wascher's (2004) expanded analysis in this *Review* of 17 OECD nations, 1975-2000, focusing on teenagers and young adults (aged 15 to 24 years) but again looking at the employment-to-population ratio.

By contrast, the parallel and burgeoning literature on employment protection is largely rooted in cross-country comparisons. And importantly Neumark and Wascher's minimum wage study draws heavily (and presciently) on arguments from this literature that might be expected either to amplify or moderate the employment consequences of minimum wages (on which more below).<sup>1</sup> Their study does not share the same breadth of outcome indicator, however, focusing instead on disemployment and eschewing consideration of labor-force participation and unemployment rates or other outcome indicators such as average hours worked.

In the present treatment, while further updating the period of analysis, we also seek to link the minimum wage and employment protection literatures. But our target group differs critically from that traditionally examined in the two literatures and espe-

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<sup>1</sup> This is an oversimplification to the extent that the existence of a minimum wage is sometimes present in the employment protection literature, where it is aggregated in a general measure of labor market (in)flexibility.

cially the minimum wage literature. That is, we will look at the labor market effects of minimum wages on workers other than teenagers and youths that are also at risk from wage minima, namely females aged 25 to 54 years. To the extent that this group of prime-age females includes low-productivity labor – reflecting their historically lower human capital accumulation due to interruptions in labor market experience and more limited access to education and training – the bite of minimum wages can also be expected to be material, and presumably more so in developing nations (Ozturk, 2006). The impact of minimum wages may be underscored by the higher-valued outside options of females, which in turn suggests that a wider range of outcomes other than employment might usefully be considered, to include participation rates. Furthermore, the existence of youth subminima that have been found to ameliorate the adverse consequences of minimum wages among that target group might be expected to have just the opposite effect among adult females.

‘Policy complementarities’ invoked by the wider literature are also examined. To this end, we examine all the labor market institutions considered by Neumark and Wascher (2004) in their innovative analysis.<sup>2</sup> As an additional refinement, we introduce time-varying measures of most such arguments. Only labor standards and in part the mechanics of minimum wage setting are one-off measures.

## **2. Previous Research**

As mentioned earlier, despite the plethora of research on the employment and other consequences of minimum wages (see Neumark and Wascher, 2007), there is scant

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<sup>2</sup> We also considered the role of other labor market institutional and policy variables such as the tax wedge and the degree of coordination in collective bargaining, as well as some other mainstream arguments such as the output-gap. These proved mostly statistically insignificant and are not further discussed here.

cross-country analysis exploiting the tremendous variation in minimum wages by nation state.<sup>3</sup> As further noted, the two principal analyses using panel data for industrialized nations are those of the OECD (1998) and Neumark and Wascher (2004).

The OECD study looks at the effect of minimum wages on the employment of teenagers, young adults, and prime-age adults for a small sample of countries, 1975-1996.<sup>4</sup> The countries are Belgium, Canada, France, Greece, Japan, the Netherlands, Portugal, Spain, and the United States. However, for the gender analysis, the sample is reduced to seven counties because of the lack of adequate series of average wages for Portugal and Spain.

The regressions follow the state-level panel data specifications now standard in the U.S. minimum wage literature. The dependent variable for the full sample is the employment-to-population ratio for teenagers aged 15 to 19 years, youths aged 20 to 24 years, and adults aged 25 to 54 years. For the reduced seven-country sample, separate male and female subsamples of each group are used. The key minimum wage ratio is calculated separately for each group using the relevant average wage and allowing for youth rates where applicable. The employment population ratio is regressed on the ratio of minimum to median wages with controls for the business cycle (the prime-age male unemployment rate and/or the output gap), different institutional features (but see below), country trend effects, and fixed country effects.

Increases in the minimum wage measure are reported to have a negative impact on teenage employment across all specifications, albeit in some instances attendant upon the exclusion of Portugal and Spain. For the full (partial) sample of countries, in the

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<sup>3</sup> Although, for meta-analyses, see Card and Krueger (1995) and Boockmann (2010).

<sup>4</sup> Note that the OECD study ranges further afield to investigate the impact of minimum wages on poverty and the income distribution and on wages and the wage distribution.

study's preferred specifications – with corrections for first-order autocorrelation for the error terms and heteroscedasticity across countries – a 10 percent increase in the minimum wage is associated with a fall in teenage employment of between 1.5 and 2 (2.7 and 4.1) percent. On the other hand, for young adults aged 20 to 24 years and for adult prime age males and females the elasticities are seldom statistically significant.<sup>5</sup>

The OECD study does not consider the role of labor market institutions/policies other than union density, the unemployment insurance (UI) replacement rate, and non-wage labor costs as a proportion of total costs (i.e. the tax wedge). (Nor for that matter does it report the respective coefficient estimates, just a summary of the estimated employment elasticities, partially documented above.) Of course, empirical analysis of the consequences of employment protection in particular has mushroomed since Lazear's (1990) pioneering study. Now-familiar institutions examined in addition to employment protection include active labor market policies, coordination in collective bargaining, and labor standards (e.g. Scarpetta, 1996; Nickell and Layard, 1999). More recent developments have allowed for interactions between institutions and economic shocks and between the institutions themselves (e.g. Blanchard and Wolfers, 2000; Addison and Teixeira, 2003; Nickell, Nunziata, and Ochel, 2005).<sup>6</sup> Yet more recent innovations have included the role of product market and business regulation, quality of industrial relations, and even family ties and religion (see, inter al., Busse and Hefeker, 2007; Fiori et al., 2007; Addison and Teixeira, 2009, Alesina et al., 2010; Feldmann, 2007). Unlike the minimum wage literature, most such analyses have focused on cross-country differences.

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<sup>5</sup> Among teenagers, female elasticities always exceeded those of males but no such gender pattern obtained in the cases of youths and adults.

<sup>6</sup> Coe and Snower (1997) were the first to provide the theoretical basis for expecting complementarities between the various labor market policies including the minimum wage.

The study by Neumark and Wascher (2004) is notable in attempting to bridge the gap between these two literatures, even if minimum wages have sometimes figured in the armory of labor market policies investigated in aggregate. Specifically, Neumark and Wascher investigate the effect of minimum wages on teenage and youth employment for seventeen countries over the (maximum) sample period 1976-2000. These countries include, in addition to those examined by the OECD (1998), Italy, Australia, Germany, Denmark, Sweden, Luxembourg, New Zealand, and the United Kingdom.

The dependent variable is the employment-to-population ratio for the particular demographic, although the minimum wage argument – the ratio of the minimum wage to the median wage – uses the adult minimum wage in the numerator and the all-worker average in the denominator. Neumark and Wascher’s basic equation regresses the employment measure on a one-year lag of the minimum-to-median wage ratio, and controls for aggregate economic conditions and supply-side forces in the form of the adult unemployment rate and the ratio of the youth population to the adult population, respectively. The authors provide results for a simple OLS specification, fixed effect models with and without controls for year effects and time trends, and a dynamic version of the model estimated using the GMM technique. In all cases, including the latter, they obtain well-determined negative coefficient estimates for the minimum wage variable. For young adults the minimum wage elasticities range from -0.13 to -0.28, and for teenagers from -0.09 to -0.31.

The authors then augment their basic estimating equations with variables representing (a) characteristics of the minimum wage system, and (b) other labor market policies and institutions. Included under (a) a bargained minimum wage (the omitted

category is statutory minimum wage determination), subnational industry/regional wage minima, and youth subminima. Abstracting from the independent effects of the different types of minimum wage machinery, and focusing on the interaction terms from the authors' fixed effect and GMM specifications, it is reported that bargained minima are associated with a smaller negative employment impact of minimum wages and conversely where there are industry or geographic wage floors. As expected, youth subminima reduce the adverse effects of minimum wages on young persons' employment, especially in the case of teenagers.

The institutions included under (b) are labor standards, employment protection, active labor market policies, the unemployment insurance (UI) replacement rate, and union density.<sup>7</sup> Again focusing on results from the preferred fixed effect and GMM specifications, the authors find evidence of certain complementarities. Thus, more restrictive labor standards and higher union density tend to exacerbate the disemployment effects of minimum wages, while stricter employment protection and active labor market policies appear to have the opposite effect. Of the institutional variables, only UI replacement rates appear to bear no relation to minimum wages – even if their independent effect is seemingly to reduce employment.

In a final application, Neumark and Wascher seek to erect a typology of minimum wage countries and investigate their component minimum wage elasticities. The categories are fourfold: high employment protection/active labor market policies in combination with either high or low labor standards and low employment protection/active labor market policies again in combination with either high or low labor standards. It emerges that

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<sup>7</sup> The authors exclude from these regressions the prior institutional arrangements centering on the mechanics of minimum wage setting.



negative employment minimum wage effects are strongest for the group of countries having the least regulation, namely Canada, Japan, the United States and the United Kingdom.

### **3. Theoretical Backdrop and Econometric Specification**

The theoretical model in this paper is implicit. It is in the spirit of Cahuc and Zylberberg (1999) and Coe and Snower (1997). Cahuc and Zylberberg offer a dynamic search and matching model with wage negotiations and employment protection (viz. severance payments and limitations on dismissals), and introduce minimum wage setting into this framework to study its impact on job creation and job destruction. Their model implies that employment protection may strongly elevate unemployment of lower skilled workers when the minimum wage is high but have little impact where the minimum wage is low (or when wages are flexible). For their part, Coe and Snower develop a model of policy complementarities and show that policies/institutions that affect the bargaining power of incumbent employees, or that influence the search behavior of the unemployed, or that influence barriers to job creation can have complementary effects on unemployment such that minimum-wage like measures that cost jobs can be magnified or ameliorated according to the restrictiveness of the ruling labor market environment. Both models, then, capture the interaction of minimum wages with labor market rigidities and labor force characteristics, and imply that minima will be less disruptive when policies are less rigid.<sup>8</sup>

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<sup>8</sup> For theoretical implications based on the conjunction of wage rigidity and mandated benefits, see Kahn (2010).

The more obvious component of the model is the extent to which the minimum wage is effective. When the minimum wage is binding, the demand curve determines the level of employment for the given minimum wage; otherwise, equilibrium employment is a function of both demand and supply. We do not model the determinants of the probability that the minimum wage will bind (see, *inter al.*, Neumark and Wascher, 2002; Addison et al., 2011) but simply attempt to capture its bite here by expressing the minimum wage as a ratio of the median wage.<sup>9</sup> (As the latter argument is only available for all workers, we supplement it with a measure of the gender wage gap interacted with the minimum wage. The argument here is that the smaller the gap between males and females, the greater the implied relative skill level of females *and* the less likely they are to be adversely impacted by hikes in the minimum wage, although we will subsequently address the potential endogeneity of this variable.) Use of the minimum to median wage ratio also reduces the bias arising from the correlation between minimum wage levels and macroeconomic events affecting minimum wage levels.

Our econometric specification is as follows:

$$Y_{it} = \alpha_i + \lambda_t + \theta_i t + \beta MW_{it-1} + \delta X_{it} + \gamma Z_i + \phi MW_{it-1} X_{it} + \zeta MW_{it-1} Z_i + \varepsilon_{it} \quad (1)$$

$$i = 1, \dots, I = 16; t = 1, \dots, T = 39$$

where  $Y_{it}$  is the prime-age female employment rate in country  $i$  and time  $t$ ;  $MW_{it-1}$  is the minimum-to-median wage ratio;  $X_{it}$  and  $Z_i$  are the time-varying and time-invariant supply, demand, and institutional arguments, respectively;  $\alpha_i$  indexes fixed country effects and  $\lambda_t$  fixed year effects;  $\theta_i$  captures the time trends in the outcome indicator for country  $i$ ; and  $\varepsilon_{it}$  is an error term. The data cover 16 countries and the time frame is 1970 to 2008.

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<sup>9</sup> On the superiority of expressing the minimum wage as a ratio of the median as opposed to the average wage in international comparisons, see OECD (1998: 38).

Observe that although our primary focus is upon the adult female employment rate, we will also consider the corresponding labor force participation and unemployment rates as in the employment protection literature.<sup>10</sup>

The time-varying arguments in the vector  $X_{it}$  comprise our three base regressors and four conventional institutional regressors. The former comprise the adult male unemployment rate, the fertility rate, and the wage gap. The latter include employment protection, union density, the unemployment insurance (UI) replacement rate, and active labor market policies. Finally, the time-invariant arguments in the vector  $Z_i$  are two-fold: the labor standards index and the presence of a youth subminimum wage. Were it not for changes in the way minimum wages are fixed in the United Kingdom all three component measures of the minimum wage machinery would also have been time invariant. Given those changes, however, both bargained minimum wages and the presence of wage floors differentiated by region and/or industry are now time varying, albeit identified by the British changes alone, leaving only the youth subminimum component time invariant. But note that all institutional components of the vectors  $X_{it}$  and  $Z_i$  are interacted with the lagged minimum wage measure.

OLS and fixed effect versions of equation (1) were run. Additionally, we estimated our preferred dynamic version of the model by including the (relevant) lagged dependent variable as a regressor. As noted earlier, the Generalized Method of Moments (GMM) technique developed by Arellano and Bond (1981) is used to estimate the dynamic model.

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<sup>10</sup> After Lazear (1990), we contemplated also using average hours as a dependent variable but did not proceed with this indicator because female hours were available for just one-half of our sample.

#### 4. Data

The data used in this inquiry are gathered from OECD online databases and published resources, and from the CEP-OECD Institutions Data Set (Nickell, 2006). The data in question cover employment-to-population ratios, unemployment rates, labor force participation rates, adult male unemployment rates (as a business cycle control), minimum wages and minimum wage rules, measures of labor market rigidity, the gender wage gap, and the fertility rate. OECD data on minimum wages are available where a national minimum wage is set by statute or by a national collective bargaining agreement. For countries where no national minimum exists, but where industry- or occupation-specific minima are set by legislation or collective bargaining agreements, we use summary estimates constructed by Dolado et al. (1996) as our base measure, following Neumark and Washer (2004). These estimates relate the minimum wage to average wages whereas the corresponding OECD values are based on the minimum-to-median wage ratio. However, a referee suggested that the data for the Nordic countries – here Sweden, Denmark, and Finland – were inappropriately low. In response to this concern, we re-estimated our *employment* models (a) dropping the Nordic group and (b) since most of the observations for the Nordic group pertain to Sweden, retaining the Nordic group but substituting four separate ‘sectors’ for that country drawing on data kindly provided by Per Skedinger.<sup>11</sup> The sectors in question are retail trade, hotels and restaurants, food and bakeries, and an across-sector measure obtained by averaging in the corresponding ratios for engineering, construction and slaughter houses to data from the three aforementioned sectors. However, in order to preserve ready comparisons with the earlier literature, our main tables preserve the Dolado et al. data, remitting our sensitivity analysis and the new estimations to appendix tables.

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<sup>11</sup> See Skedinger (2010).

**Table 1. Minimum Wage Levels and Rules**

Country	Minimum-to-Median Wage Ratio			Bargained Minimum Wage	Presence of Subnational Minimum Wage		Presence of Youth Subminimum Wage	
	First Observation	Last Observation	Average					
Australia	0.65 (1985)	0.52	0.60	no		no	yes	<21
Belgium	0.54 (1975)	0.5	0.54	yes		no	yes	<21
Canada	0.48	0.41	0.41	no		yes Province	no	
Denmark	0.55	0.54 (1994)	0.54	yes		yes Industry	yes	<18
Finland	0.52 (1993)	0.52 (1993)	0.52	yes		yes Industry	yes	<18
France	0.42	0.62	0.54	no		no	no	Limited
Germany	0.57	0.58 (1994)	0.59	yes		yes Industry	no	Some
Ireland	0.67 (2000)	0.52	0.54	no		no	yes	<18
Italy	0.78 (1976)	0.71 (1991)	0.73	yes		yes Industry	no	Some
Japan	0.78 (1975)	0.34	0.31	no		yes Prefecture	no	
The Netherlands	0.58	0.42	0.52	no		no	yes	<23
New Zealand	0.6	0.59	0.52	no		no	yes	<20
Spain	0.7	0.44	0.43	no		no	yes	<18
Sweden			0.53					
	0.53 (1975)	0.51	(0.79/0.80/0.83/0.73)	yes		yes Industry	yes	<24
United Kingdom	0.365	0.46	0.44	yes/no	Wages Councils [up to 1993] / statute (after 1999)	yes /no [Industry]	yes	<21
United States	0.49	0.34	0.38	no		yes State	no	Limited

*Note:* The information in the first and second columns refers to minimum-to-median (or minimum-to-mean) wage ratios in 1970 and 1978, respectively, unless otherwise stated. The figures in the third column give average values for the relevant ratio. The higher values shown here in parentheses for Sweden are taken from Skedinger (2010) and give minimum-to-mean wage ratios for four separate sectors (see text). The series from which the latter are drawn are used in our sensitivity analysis.

*Sources:* Minimum-to-median wage ratios are taken from the OECD online database for all countries, other than Denmark, Germany, Italy, Sweden, and the United Kingdom (before 1933) where we use estimates constructed by Dolado et al. (1996) as our base measure following Neumark and Wascher (2004). Minimum wage rules are from Neumark and Wascher (2004: 228) and the ILO TRA VAIL Legal database.

Most OECD countries have some sort of minimum wage policy. Table 1 provides information on these minima, as well as the machinery of minimum wage determination, for those countries for which we have been able to assemble consistent data on all variables. As is immediately evident, the countries differ not only in terms of the relative level of minimum wages – and hence in the potential bite of minimum wages – but also in rule setting. The first two columns of the table give the relative values of the minimum wage at two points in time, namely 1970 and 2008, unless otherwise stated. For most countries, minimum-to-median (or minimum-to-mean) wage ratios declined through time; the principal exceptions being France and the United Kingdom. European countries generally have higher relative values of the minimum wage than their non-European counterparts, including the United States. This empirical regularity has of course been noted in the wider literature and, taken in conjunction with the greater degree of labor market regulation obtaining in Europe, cited as a principal cause of that region’s high unemployment rates (e.g. Siebert, 1997). We also give average values of the minimum wage in the third column of the table. The figures in parentheses for Sweden are taken from Skedinger (2010) and give the ratio of the minimum wage to the average wage in the four sectors mentioned earlier. As is evident, each value exceeds the Dolado et al. measure.

The last three columns of Table 1 describe the minimum wage fixing machinery. The first indicates how minimum wages are determined. Here ‘yes’ signifies that the minimum wage is negotiated (i.e. set via bipartite or tripartite negotiations), while ‘no’ signifies the wage is set by statute. For the United Kingdom we observe a switch in regimes from bargained (via tripartite wages councils) to statutory minimum wages over

the sample period. The fourth column shows whether the minimum wage is national in scope or instead varies across industries or regions; for example, in Japan the minimum wage varies across prefectures, whereas in the United States each state can set its own minimum exceeding the federal level.<sup>12</sup> For our sample of countries, regional and industry variation is more common than a unified national minimum. The final column of the table indicates whether there are any subminimum wages for younger persons and, if so, the age at which they apply.<sup>13</sup>

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<sup>12</sup> The ‘new minimum wage research’ in the United States has used this geographic variation to help identify employment effects, albeit in quite different ways (cf. Neumark and Wascher, 1992; Card and Krueger, 1994).

<sup>13</sup> As noted by Neumark and Wascher (2004: note 18), the classification of minimum wage systems is inevitably open to some discretion, especially with respect to youth subminima. We follow their convention in treating the cases of Italy, France, Germany and the United States, where there is some such limited wage differentiation as having no such differentiation. On the broader question of Germany, where the differentiation stems from its famous apprenticeship system, there is of course the very much wider issue of whether that nation is properly classified as having minimum wages at all – at least prior to the recent posted workers act and latterly the introduction of minima for individual sectors such waste disposal. As a practical matter, the exclusion of Germany did not materially affect any of the major findings reported below or earlier; full results are available from the authors upon request.

**Table 2a. Means (Standard Deviations) of Labor Market Outcomes, and Gender Variables**

Country	Employment-to- Population Ratio	Labor Force Participation Rate (LFPR)	Unemployment	Fertility	Wage Gap
Australia	0.586 (0.094)	0.619 (0.101)	0.052 (0.015)	1.969 (0.295)	0.170 (0.026)
Belgium	0.609 (0.087)	0.678 (0.077)	0.104 (0.031)	1.709 (0.170)	0.122 (0.031)
Canada	0.672 (0.087)	0.726 (0.088)	0.075 (0.015)	1.679 (0.174)	0.271 (0.129)
Denmark	0.792 (0.023)	0.848 (0.018)	0.066 (0.021)	1.719 (0.171)	0.132 (0.012)
Finland	0.785 (0.040)	0.831 (0.042)	0.055 (0.035)	1.727 (0.086)	0.227 (0.026)
France	0.643 (0.076)	0.705 (0.098)	0.084 (0.033)	1.903 (0.203)	0.164 (0.058)
Germany	0.611 (0.091)	0.657 (0.112)	0.066 (0.027)	1.442 (0.163)	0.252 (0.022)
Ireland	0.469 (0.162)	0.509 (0.161)	0.084 (0.051)	2.523 (0.702)	0.190 (0.045)
Italy	0.444 (0.097)	0.490 (0.117)	0.088 (0.039)	1.561 (0.394)	0.166 (0.011)
Japan	0.603 (0.050)	0.621 (0.058)	0.028 (0.012)	1.619 (0.272)	0.379 (0.038)
The Netherlands	0.518 (0.184)	0.548 (0.193)	0.054 (0.033)	1.682 (0.223)	0.237 (0.046)
New Zealand	0.691 (0.036)	0.726 (0.031)	0.048 (0.014)	2.152 (0.330)	0.162 (0.069)
Spain	0.403 (0.131)	0.479 (0.164)	0.145 (0.085)	1.765 90.630)	0.231 (0.060)
Sweden	0.806 (0.066)	0.836 (0.072)	0.036 (0.022)	1.778 (0.174)	0.172 (0.019)
United Kingdom	0.701 (0.045)	0.742 (0.033)	0.057 (0.021)	1.829 (0.175)	0.307 (0.075)
United States	0.653 (0.088)	0.688 (0.089)	0.052 (0.012)	1.968 (0.149)	0.287 (0.070)
Total	0.619 (0.152)	0.664 (0.156)	0.068 (0.044)	1.814 (0.400)	0.225 (0.090)
correlation with the lagged minimum wage measure	0.042	0.155	0.508	0.773	-0.716

*Sources:* The labor market indicators (including unemployment rates) are taken from the OECD.Stat online data base. Fertility rates are from the OECD Family data base. The wage gap is the difference between median male and female wages expressed as a percentage of the male median wage. This variable is generated using OECD data. The mean wage ratio is used instead for The Netherlands, downloaded from [www.oecd.org/dataoecd/9/59/39606921.xls](http://www.oecd.org/dataoecd/9/59/39606921.xls). The fertility rate and wage gap variables are standardized for the regressions.



There are also significant cross-country differences in the extent of labor market regulation, socio-demographics, and labor market activity, as charted in Tables 2a and 2b. Beginning with the outcome indicators in Table 2a, although the observed changes in female labor force participation rates are consistent with the general worldwide trend (increasing in all of the countries over the thirty-nine year period), participation rates vary sometimes quite considerably. Thus, at any point in time, Italy, and Spain have significantly lower participation rates when compared with other countries, and especially the Nordic nations of Finland, Denmark, Norway and Sweden. Participation rates are one of the margins investigated in the present treatment because minimum wages, and other rigidities, may inhibit low productivity workers from actively seeking employment once unemployed. On the other hand, they may encourage the labor market entry of other such individuals (see, for example, Mincer, 1976).

Employment-to-population ratios rose significantly in all countries other than Sweden and Finland, where the observed changes were modest. Although employment rates do vary markedly across countries – from just 40.3 percent in Spain to 80.6 percent in Sweden – it is unemployment rates that show the greatest variance over the sample period. Even if by the early 2000s unemployment rates were close to their 1980 values, most European countries experienced very high unemployment in the intervening years. And the female unemployment rate actually rose from 1.7 percent in 1970 to 6.6 percent in 2009.

In general, fertility rates declined significantly over the sample period; the exceptions being Norway, the United Kingdom, the Netherlands, and Sweden. In the 1980s the fertility rate averaged 2.5 children per woman cross all OECD countries. By 2004 this

average had declined to 1.8 children (and was even as low as 1.6 children during the late 1990s). Child birth is the main reason for interruptions in a woman's work life and caring for young children either keeps women off the market or directs them to careers that permit flexibility to balance work and family. Such interruptions and career choices imply lower wages for women vis-à-vis men of the same age and education.

The wage gap given in the last column of Table 2a is the difference between median male and female wages expressed as a percentage of the median male wage. As noted earlier, this variable was included to capture the existence of gender differences in occupational choice and education that might be expected to affect the bite of minimum wages in the case of females. Historically, females have had lower rates of labor market attachment and have tended to concentrate in lower-paying occupations, both of which tendencies make them susceptible to minimum wage-induced disemployment. As can be seen from the table, the wage gap averaged 22.5 percent over the period, ranging from 12.2 percent in Belgium to 37.9 percent in Japan.

**Table 2b. Means (Standard Deviations) of Labor Market Structural Variables**

<i>Country</i>	Labor Standards Index	Employment Protection	Active Labor Market Policies	Union Density	Unemployment Insurance Replacement Rate
Australia	3	0.335 (0.048)	5.685 (0.667)	5.468 (9.443)	23.12 (3.368)
Belgium	2	0.955 (0.159)	15.04 (1.924)	12.87 (23.23)	42.45 (2.556)
Canada	1	0.270 (0.000)	6.026 (0.369)	7.381 (13.21)	17.58 (2.339)
Denmark	2	0.655 (0.146)	24.58 (6.306)	25.96 (34.85)	50.11 (8.053)
Finland	3	0.733 (0.043)	15.41 (5.129)	17.99 (32.49)	30.98 (7.488)
France	3	0.929 (0.105)	10.04 (1.480)	2.318 (4.070)	33.82 (6.257)
Germany	4	0.970 (0.128)	18.76 (4.020)	5.370 (9.493)	28.45 (1.101)
Ireland	2	0.297 (0.052)	16.34 (6.526)	13.48 (17.99)	29.09 (6.312)
Italy	3	1.049 (0.235)	11.11 (0.533)	7.949 (14.14)	13.19 (14.45)
Japan	1	0.677 (0.049)	4.787 (1.120)	4.683 (8.306)	9.988 (1.793)
The Netherlands	4	0.845 (0.090)	30.64 (12.36)	5.197 (9.212)	51.32 (2.803)
New Zealand	3	0.350 (0.088)	11.69 (2.849)	5.249 (9.226)	29.01 (1.814)
Spain	3	1.184 (0.141)	4.105 (1.222)	3.241 (5.853)	30.17 (8.196)
Sweden	5	0.889 (0.268)	48.72 (19.13)	18.19 (32.66)	23.86 (6.379)
United Kingdom	0	0.202 (0.022)	7.582 (1.484)	7.155 (12.56)	19.86 (3.361)
United States	0	0.070 (0.000)	3.587 (0.349)	2.949 (5.170)	12.86 (1.301)
Total	2.434 (1.370)	0.651 (0.359)	14.63 (13.15)	9.090 (19.02)	27.87 (13.32)
correlation with the lagged minimum wage measure	0.658	-0.119	0.436	0.031	0.711

*Sources:* The labor standards index is as described by Neumark and Wascher (2004: 237). It refers to the situation as of 1993 and is taken from the OECD Jobs Study (1994) and specifically excludes the contributions of minimum wages and employment protection policies. The employment protection variable is taken from Nickell (2006) and is the employment protection legislation data from the OECD.Stat using Version 1 of that indicator: the strictness of employment protection legislation. Nickell (2006) extends this data using Blanchard and Wolfers (2000). These data are available only until 2004, with 2004 values being used for later years. The union density measure is again taken from Nickell (2006) and is calculated as union membership divided by employment, using administrative and survey data from the OECD labor market statistics data base. This base measure is then extended by splicing in data from Visser (2006). These data are available only until 2004, with 2004 values being used for later years. The unemployment insurance replacement rate is the original benefit replacement rate data published by the OECD. These data are also available only until 2004, with 2004 values again being used for later years. The active labor market policies variable is taken from Nickell (2006). It is calculated as expenditures divided by the unemployment rate. These data are available only until 2004; missing values are now interpolated using unemployment and GDP measures. All variables are standardized for the regressions.

Finally, there are striking differences in the labor market conditions and institutions of countries in the data, which can potentially shape the manner and the intensity with which minimum wages affect the outcome indicators. Thus, for example, one can readily envisage how any (dis)employment effects of minimum wages might be amplified by other labor market rigidities, such as national restrictions on hours adjustment or the use of flexible contracts. However, if there are also institutions in place that help the unemployed locate jobs, the frictions resulting from the impedimenta of minimum wage changes may be considerably attenuated. For these reasons, as noted earlier, we include in the model measures of labor standards, of the strictness of employment protection laws, of the extent of active labor market policies, of the generosity of UI replacement rates, and of the degree of unionization rates. Table 2b provides the descriptive statistics.

## 5. Findings

### 5.1 *Basic Regression Results*

Our initial *cet. par.* results are provided in Table 3 for the adult female employment-to- population ratio and the adult female labor force participation rate, although we shall focus on the former. (Results for the adult female unemployment rate are remitted to Appendix Table 3.) Each of the OLS results given in the first three columns of the table excludes country fixed effects. The results in the first column include our wage gap and fertility arguments but no country-specific trend and year fixed effects. This specification reveals a well-determined negative association between the minimum wage argument and female employment and the expected negative coefficient estimate for the general labor demand measure, namely the adult male unemployment rate. For their part, and less and

more obviously perhaps, the coefficients for the wage gap and fertility are also negative, but their interaction terms are both positive. The implication is that the net effect of the wage gap (fertility rates) on employment is negative if the ratio of the minimum wage to the media wage is less than 2.29 (0.34). But as a practical matter, the diagnostics at the foot of the table indicate that we can reject the restriction that the year and country controls and time trends are excludable.

**Table 3. Estimates of the Standard Minimum Wage Model Using International Data**

Variable	Adult Female Employment-to-Population Ratio								Adult Female Labor Force Participation Rate (LFPR)							
	OLS		FE		GMM				OLS		FE		GMM			
Lagged Adult Female Employment					0.704***	0.681***										
					[0.070]	[0.072]										
Lagged Adult Female LFPR													0.708	0.699***		
													[0.000]	[0.075]		
Lagged Min-to-Median Wage Ratio	-0.306***	-0.477***	-0.279***	-0.139	-0.114***	-0.063***	-0.062***		-0.328***	-0.313***	-0.485***	-0.134	-0.109**	-0.037	-0.035**	
	[0.063]	[0.088]	[0.067]	[0.088]	[0.034]	[0.022]	[0.020]		[0.067]	[0.067]	[0.095]	[0.078]	[0.041]	[0.000]	[0.017]	
Adult Male Unemployment Rate	-0.614***	-0.966***	-0.588***	-0.645**	-0.622***	-0.355***	-0.367***		0.085	-0.125	-0.481**	-0.182	-0.183	-0.101	-0.111*	
	[0.204]	[0.186]	[0.182]	[0.134]	[0.122]	[0.052]	[0.049]		[0.201]	[0.185]	[0.189]	[0.162]	[0.152]	[0.000]	[0.059]	
Wage Gap	-0.096***	-0.02			0.071***		0.017**		-0.085***	-0.025			0.071***		0.013	
	[0.020]	[0.022]			[0.016]		[0.009]		[0.021]	[0.022]			[0.018]		[0.009]	
Fertility Rate	-0.202***	-0.579***			0.012		0.009		-0.196***	-0.665***			0.007		-0.001	
	[0.046]	[0.093]			[0.032]		[0.016]		[0.045]	[0.097]			[0.037]		[0.017]	
<i>Lagged Minimum-to-Median Wage Ratio interacted with:</i>																
Wage Gap	0.042	-0.064			-0.160***		-0.035*		0.001	-0.059			-0.158***		-0.030*	
	[0.049]	[0.054]			[0.034]		[0.018]		[0.053]	[0.054]			[0.041]		[0.017]	
Fertility Rate	0.586***	1.325***			0.042		-0.016		0.526***	1.432***			-0.002		-0.013	
	[0.095]	[0.173]			[0.076]		[0.040]		[0.096]	[0.186]			[0.090]		[0.040]	
Constant	0.843***	0.640***	0.681***	0.454***	0.416***	0.165***	0.167***		0.853***	0.696***	0.692***	0.455***	0.431***	0.146	0.151***	
	[0.026]	[0.039]	[0.035]	[0.046]	[0.022]	[0.024]	[0.025]		[0.027]	[0.039]	[0.039]	[0.039]	[0.026]	[0.000]	[0.024]	
Minimum Wage Elasticity	-0.394***	-0.463**	-0.279***	-0.139	-0.106*	-0.063***	-0.056***		-0.403***	-0.513**	-0.485***	-0.134	-0.095	-0.037	-0.030***	
	[0.096]	[0.222]	[0.067]	[0.088]	[0.065]	[0.022]	[0.014]		[0.086]	[0.239]	[0.095]	[0.078]	[0.063]	[0.000]	[0.012]	
Country Fixed Effects	NO	NO	NO	YES	YES	YES	YES		NO	NO	NO	YES	YES	YES	YES	
Year Fixed Effects	NO	YES	YES	YES	YES	YES	YES		NO	YES	YES	YES	YES	YES	YES	
Country Specific Time Trends	NO	YES	YES	YES	YES	YES	YES		NO	YES	YES	YES	YES	YES	YES	
Observations	339	339	339	339	339	307	307		339	339	339	339	339	307	307	
R-squared	0.527	0.889	0.847	0.982	0.985				0.514	0.882	0.834	0.983	0.985			
Number of Countries				16	16	14	14					16	16	14	14	
Hausman / Sargan tests (p-values)	0.000	0.000	0.000	0.000	0.000	0.000	-		0.000	0.000	0.000	0.000	0.000	0.000	-	

*Notes:* Hubert-White robust standard errors are given in parenthesis. The STATA xtreg command reports a constant for the fixed effects regressions: It is the mean of all country-specific effects. The Hausman specification test is for the exclusion of year and country controls and time trends in the first specification, for the exclusion of the country fixed effect in the second specification, and for the exclusion of the wage gap and fertility variables and their minimum wage measure interactions in the third, fourth and sixth specification for each outcome variable. We also use the Hausman test to determine whether the assumption of no correlation between the error terms and the independent variables is correct. As this restriction is rejected in all specifications, we only report the fixed effects regression

\*Statistically significant at the .10 level, \*\* at the .05 level, \*\*\* at the .01 level.

Turning therefore to the results in the second column of the table, the coefficient estimate for the minimum wage variable is somewhat higher in absolute terms than before. The same is true of the other coefficients with the exception of the wage gap. Moreover, the wage gap-minimum wage interaction term is now also negative – as is to be expected if the wage gap is an inverse measure of the skill level of the female workforce with a greater wage gap implying an increased bite of the minimum wage – suggesting that wage gap effects are reinforcing in reducing female employment. As before, higher fertility is associated with reduced employment but the interaction term is positive. In this case, the net effect of higher fertility rates on female employment is negative if the minimum-to-median wage ratio is less than 0.44. The estimated minimum wage elasticity, computed as the coefficient on the minimum wage variable plus each of the coefficients on the interaction terms multiplied by the standardized values of the corresponding covariates, indicates that a 10 percent increase in the lagged minimum wage variables minimum wage gap variable is associated with a 4.6 percent fall in female employment, which is of course a high value for developed nations. But again the bottom line diagnostic is that the exclusion restriction (here an absence of country fixed effects) is again contraindicated.

In the third column of the table, we report results from dropping the fertility and wage gap variables on the grounds of their potential endogeneity. For example, if minimum wage hikes narrow the wage gap, this should lead to an understatement of the effect of minimum wages on employment in equations containing both arguments (see, in particular, Blau and Kahn, 2003, on the effect of wage floors on female relative wages).

Observe however that in this specification excluding both arguments reduces rather than increases the absolute magnitude of the lagged minimum wage coefficient.

Given the indication that country effects are important, what are the consequences of controlling for country fixed effects as well as year fixed effects and country specific time trends? The results are given in the fifth column of Table 3. The most obvious effect is of course a marked fall in the coefficient estimate for the minimum wage variable, indicating that a sizable part of the effect obtained earlier does, as expected, reflect country-specific factors. But the lagged minimum wage argument remains highly significant, even if the estimated minimum wage elasticity (of -0.106) on this occasion is only marginally statistically significant. The coefficient estimate for the demand argument (the adult male unemployment rate) remains highly significant albeit reduced in absolute magnitude. Interestingly, the own effect of the wage gap variable effect is now positive and well determined, while its effect when interacted with lagged minimum wage is strongly negative. The implication is that the net effect of the wage gap on employment is negative if the minimum wage ratio exceeds 0.44. The own and interaction effects of fertility are positive and reinforcing although neither coefficient estimate is statistically significant. On this occasion, the results of dropping the wage gap and fertility rate variables – shown in the fourth column of the table – are more modest than before. That is, the absolute magnitude of the lagged minimum wage coefficient increases rather modestly in absolute magnitude.

Our preferred estimates are given in the seventh column of the table for the dynamic employment model. These GMM estimates do indicate a further diminution in the point estimate of the lagged minimum wage coefficient but both it and the minimum



wage elasticity are highly significant. The signs and significance levels of the coefficients of the other variables carry over from the fixed effects specification to the dynamic version of the model, although each is reduced in absolute magnitude. Observe that the inclusion of the lagged employment rate – which is highly significant – can also be interpreted as helping to distinguish between the short-run and long-run effects of the minimum wage on employment. Given these estimates, -0.062 is the short-run coefficient and -0.194 ( $= -0.062 / (1 - 0.681)$ ) is the long-run coefficient. The own and interaction effects of the wage gap and fertility arguments are of opposing sign and imply that the net effect of a greater wage gap on female employment is negative if the minimum-to-mean wage ratio exceeds 0.49, and that the net effect of higher fertility is negative if that ratio exceeds 0.56. Observe from the sixth column of the table that some understatement of the minimum wage effect is implied by the inclusion of the wage gap argument, but it is now only at the third decimal place.

Before turning to the results for labor force participation contained in the remaining columns of Table 3, we pause to take note of the effects of excluding all three Nordic countries from the sample and then reinstating them but with Skedinger’s data in the form of four separate minimum-wage-to-median-wage series for the retail, hotel and restaurants, and food/bakery sectors and a cross-sector average measure (all the previous sectors plus engineering and construction. The results are provided in Appendix Tables 1 and 2, respectively. First, the exclusion of Denmark, Finland, and Sweden makes very little difference to the results reported earlier. That is, the pattern of the coefficients estimates is broadly replicated and for our preferred GMM specification the point estimates are particularly close. Reinstating the Nordic countries but with the new *data* for Sweden

in Appendix Table 2 scarcely changes the picture. We conclude that our employment results reported thus far are essentially unchallenged by data issues attendant on an understatement in part of the of the key minimum wage argument deployed in the previous literature and the present treatment. But we will need to see if the same applies when we estimate our augmented model.

Turning therefore to the last seven columns of Table 3, we repeat each specification used earlier but for a different outcome indicator: the adult female *labor force participation rate*. The bottom line of this exercise is that disemployment appears to have something of a counterpart in lowered female labor force participation. In all full regressions, the coefficient estimate for the lagged minimum wage is negative and statistically significant. But few other arguments are statistically significant across specifications. For the fixed effect and GMM estimates, the net effect of a higher wage gap on participation is negative if the minimum wage ratio is greater than 0.45 or greater than 0.43, respectively. The effects of the fertility rate are negative and reinforcing for the GMM specification, although in the case of the fixed effect specification they would only become negative if the minimum wage were to equal three and one-half times the median wage! Excluding the minimum wage in all cases raises the coefficient estimate for the lagged minimum wage, but in our preferred GMM specification any implied understatement of the minimum wage effect would appear inconsequential.

Finally, results for adult female unemployment are provided in Appendix Table 3 and generally offer some suggestion that minimum wage increases feed into higher female employment. Thus, an adverse minimum wage effect is clearly discernible for our

preferred specification, where again inclusion of the wage gap argument seemingly provides little understatement of any minimum wage effect.

## 5.2 *The Augmented Model*

We now examine whether the employment effects of the minimum wage are influenced by differences in minimum wage systems across countries and by the presence of diverse labor market policies or institutions. As far as the minimum wage is concerned, we consider the method used to set minimum wages (whether it was bargained, as opposed to being statutorily determined), whether provision is made for a youth subminimum, and the presence of subnational minima (i.e. wage floors that vary across regions/industries). At the same time – rather than sequentially as in Neumark and Wascher – we also examine the role of more encompassing employment protection, higher labor standards, and greater union density, as well as more generous UI systems and more comprehensive active labor market policies. Observe that, with the two exceptions noted earlier, all of these variables are time varying rather than fixed as in Neumark and Wascher.<sup>14</sup>

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<sup>14</sup> Since it might be objected that our gender controls are thin, as part of our augmentation strategy we also experimented with a parental leave variable, measured as weeks of entitlement and constructed combining information from Ruhm and Teague (1997) and Ruhm (1998) with OECD data. Parental leave may stimulate the employment and participation rates of women – while lowering their unemployment – by increasing their stability in the firm and also by encouraging them to qualify for leave benefits. On the other hand, increases in the cost of employing eligible women might lead employers to discriminate against them in employment, particularly if minimum wage hikes make it less possible for women to ‘pay’ for their leave. In the event, our parental leave measure was strongly and negatively correlated with the wage gap argument in each country, while its inclusion in the fitted model was formally contraindicated. Problems associated with the sparse formal representation of ‘gender and the labor market’ in this study are of course mitigated by the use of country fixed effects.

**Table 4. Estimates of the Augmented Minimum Wage Model with Characteristics of Minimum Wage Systems and Other Labor Market Policies and Institutions for the Employment and Labor Force Participation Outcomes**

Variable	Adult Female Employment-to-Population Ratio						Adult Female Labor Force Participation Rate (LFPR)					
	OLS		FE		GMM		OLS		FE		GMM	
Lagged Adult Female Employment					0.618***	0.602***						
					[0.073]	[0.072]						
Lagged Adult Female LFPR											0.672***	0.660***
											[0.063]	[0.063]
Lagged Min to Median Wage Ratio	-1.655***	-1.454***	-0.477***	-0.394***	-0.312***	-0.304***	-1.760***	-1.525***	-0.480***	-0.432**	-0.210**	-0.237**
	[0.275]	[0.199]	[0.122]	[0.133]	[0.058]	[0.058]	[0.304]	[0.210]	[0.112]	[0.136]	[0.069]	[0.061]
Adult Male Unemployment Rate	-1.014***	-0.857***	-0.558***	-0.543***	-0.370***	-0.377***	-0.549***	-0.413***	-0.161	-0.163	-0.113	-0.123*
	[0.133]	[0.126]	[0.111]	[0.102]	[0.050]	[0.048]	[0.120]	[0.116]	[0.158]	[0.147]	[0.069]	[0.069]
Wage Gap		0.041		0.057**		0.030**		0.078**		0.076**		0.026*
		[0.032]		[0.022]		[0.012]		[0.032]		[0.033]		[0.015]
Fertility Rate		-0.194***		-0.055		-0.039**		-0.235***		-0.038		-0.033*
		[0.053]		[0.044]		[0.015]		[0.054]		[0.038]		[0.017]
Bargained Minimum Wage	0.318***	0.265***	0.018	0.032			0.225**	0.225***	0.03	0.04		
	[0.083]	[0.083]	[0.065]	[0.065]			[0.087]	[0.084]	[0.062]	[0.072]		
Youth Subminimum	-0.849***	-0.623***					-0.878***	-0.630***				
	[0.145]	[0.117]					[0.152]	[0.119]				
Subnational Minimum	-0.509***	-0.463***					-0.429***	-0.431***				
	[0.146]	[0.118]					[0.161]	[0.122]				
Employment Protection Index	-0.159***	-0.181***	-0.041	-0.068	-0.03	-0.052**	-0.155***	-0.177***	-0.038	-0.062	-0.024	-0.046**
	[0.031]	[0.030]	[0.044]	[0.055]	[0.021]	[0.026]	[0.031]	[0.029]	[0.058]	[0.067]	[0.020]	[0.022]
Union Density	0.079***	0.003	-0.039	-0.025	-0.009	-0.008	0.108***	0.032	-0.004	0.005	0.002	-0.002
	[0.028]	[0.031]	[0.025]	[0.022]	[0.010]	[0.008]	[0.029]	[0.028]	[0.018]	[0.022]	[0.011]	[0.012]
Unemp. Insurance Replacement Rate	-0.120***	-0.074**	-0.093*	-0.100***	-0.081***	-0.098***	-0.047	-0.021	-0.043	-0.044	-0.056***	-0.065***
	[0.044]	[0.037]	[0.046]	[0.040]	[0.022]	[0.022]	[0.044]	[0.037]	[0.052]	[0.041]	[0.018]	[0.019]
Active Labor Market Policies	0.073***	0.051**	0.014	0.006	-0.013	-0.013	0.062**	0.035	-0.003	-0.012	-0.014	-0.013
	[0.027]	[0.024]	[0.019]	[0.019]	[0.012]	[0.012]	[0.028]	[0.024]	[0.018]	[0.020]	[0.016]	[0.015]
Labor Standards Index	0.266***	0.258***					0.322***	0.318***				
	[0.057]	[0.051]					[0.064]	[0.050]				

*continues on the next page*

*Lagged Minimum to Median Wage Ratio interacted with:*

*continues from the previous page*

Wage Gap		-0.211***		-0.126***		-0.060**		-0.290***		-0.174**		-0.058*
		[0.065]		[0.052]		[0.028]		[0.067]		[0.077]		[0.033]
Fertility Rate		0.391***		0.120		0.055		0.409***		0.055		0.031
		[0.113]		[0.115]		[0.039]		[0.114]		[0.102]		[0.040]
Bargained Minimum Wage	-0.518***	-0.534***	-0.481**	-0.575***	-0.373***	-0.431***	-0.355*	-0.431***	-0.335*	-0.469**	-0.226*	-0.304**
	[0.174]	[0.156]	[0.192]	[0.200]	[0.123]	[0.138]	[0.185]	[0.161]	[0.176]	[0.213]	[0.127]	[0.152]
Youth Subminimum	1.629***	1.200***	0.484**	0.370*	0.291***	0.280***	1.720***	1.207***	0.472**	0.363*	0.202***	0.228***
	[0.298]	[0.230]	[0.198]	[0.175]	[0.077]	[0.080]	[0.317]	[0.237]	[0.176]	[0.197]	[0.078]	[0.077]
Subnational Minimum	1.215***	1.220***	0.458**	0.516**	0.323***	0.401***	1.088***	1.140***	0.258	0.365**	0.165**	0.258***
	[0.298]	[0.223]	[0.213]	[0.188]	[0.077]	[0.069]	[0.329]	[0.233]	[0.185]	[0.156]	[0.080]	[0.067]
Employment Protection Index	0.220***	0.240***	0.08	0.134	0.057	0.098**	0.239***	0.237***	0.077	0.115	0.048	0.085**
	[0.059]	[0.059]	[0.081]	[0.104]	[0.037]	[0.047]	[0.059]	[0.059]	[0.114]	[0.131]	[0.037]	[0.041]
Union Density	-0.154***	-0.028	0.059	0.037	0.001	0.002	-0.194***	-0.069	0.001	-0.013	-0.012	-0.004
	[0.051]	[0.054]	[0.045]	[0.036]	[0.019]	[0.016]	[0.053]	[0.051]	[0.039]	[0.042]	[0.023]	[0.024]
Unemp.Insurance Replacement Rate	0.060	0.070	0.147	0.156*	0.150***	0.179***	-0.05	0.001	0.089	0.09	0.120***	0.137***
	[0.084]	[0.069]	[0.087]	[0.075]	[0.044]	[0.042]	[0.086]	[0.070]	[0.094]	[0.073]	[0.043]	[0.043]
Active Labor Market Policies	-0.125**	-0.076*	-0.013	0.003	0.031	0.032	-0.109**	-0.047	0.015	0.033	0.029	0.03
	[0.050]	[0.044]	[0.035]	[0.037]	[0.025]	[0.025]	[0.054]	[0.044]	[0.034]	[0.039]	[0.033]	[0.031]
Labor Standards Index	-0.384***	-0.388***	-0.031	-0.09	-0.117*	-0.160**	-0.529***	-0.531***	-0.136	-0.193	-0.135*	-0.176**
	[0.101]	[0.091]	[0.114]	[0.115]	[0.062]	[0.062]	[0.112]	[0.089]	[0.136]	[0.142]	[0.071]	[0.073]
Constant	1.113***	1.080***	0.394***	0.377***	0.164***	0.154**	1.179***	1.154***	0.435**	0.434***	0.141***	0.144***
	[0.115]	[0.085]	[0.037]	[0.048]	[0.049]	[0.060]	[0.127]	[0.090]	[0.045]	[0.050]	[0.043]	[0.053]
Minimum Wage Elasticity	-1.016***	-0.981***	-0.319***	-0.268***	-0.207***	-0.194***	-1.096***	-1.039***	-0.338***	-0.303***	-0.139**	-0.149***
	[0.267]	[0.202]	[0.119]	[0.107]	[0.089]	[0.092]	[0.309]	[0.245]	[0.102]	[0.095]	[0.071]	[0.076]
Country Fixed Effects	NO	NO	YES	YES	YES	YES	NO	NO	YES	YES	YES	YES
Year Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country Specific Time Trends	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	339	339	339	339	307	307	339	339	339	339	307	307
R-squared	0.959	0.972	0.988	0.989			0.953	0.971	0.985	0.987		
Number of Countries			16	16	14	14			16	16	14	14
Hausman / Sargan tests (p-values)	0.000	0.000	0.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	-

*Notes:* See Notes to Table 3. All minimum wage setting institution dummies are time invariant in all countries except for the subnational minimum wage dummy and the negotiated minimum wage dummy for Britain. Thus, in columns (2) and (4) the coefficient for negotiated minimum wage dummy is identified only with British data. We do not estimate a coefficient for the negotiated minimum wage dummy because this variable is dropped due to collinearity.

\*Statistically significant at the .10 level, \*\* at the .05 level, \*\*\* at the .01 level.

Results for the augmented model are given in Table 4. The OLS results for employment shown in the second column of the table suggest that bargained minimum wages (as opposed to statutorily-determined minima) have an ambiguous effect on female employment. Although the own effect of a bargained minimum is positive, the interaction term is negative, such that the net effect on employment is negative as long as the ratio of the minimum wage to the median wage is greater than 0.50. Whatever the benefits of the flexibility introduced by bargained minimum wage systems for other groups of workers, then, the results for females are mixed. For its part the net effect of subnational minima at industry or regional level is negative of the minimum wage ratio is less than 0.38. And although the own effect of a youth subminimum is negative the interaction term is positive such that the presence of a youth minimum is on net associated with lower female employment rates where the minimum wage ratio is less than 0.52. One possibility here is that the youth ‘discount’ is lower the higher the minimum wage. As far as the other institutions are concerned, the own effect of more generous employment protection and higher UI replacement rates is negative while that of active labor market policies and labor standards is positive. But in each case the associated interaction terms are opposite in sign such that the net effects of employment protection (unemployment insurance) are negative if the minimum wage ratio is less than 0.75 (1.06, which is of course always the case). As far as active labor market policies (labor standards) is concerned, the net effect is negative if the minimum wage ratio exceeds 0.67 (0.66). The union coefficients while insignificant imply that higher union density has a negative effect when the minimum wage ratio is greater than 0.11 which is always the case in our data. Finally, with respect to the fertility rate and wage gap

measures, it is the case that higher fertility rates depress female employment on net where the minimum wage ratio is less than 0.50 while the net impact of the wage gap is always negative since the minimum wage ratio always exceeds the tipping point of 0.19 in our data. When we omit the wage gap and fertility variables on account of their potential endogeneity (see the first column of Table 4) the pattern and significance of the other coefficient estimates is largely unaffected and the expected increase in the coefficient estimate of the lagged minimum wage is but modest. Similarly, the absolute value of the minimum wage elasticity is little affected. We therefore have greater confidence in the use of both variables. More generally and as before, we can reject the exclusion of country effects in this specification.

Fixed effects and our preferred GMM estimates are contained in the fourth and sixth columns of Table 4, prefaced in each case by a specification that exclude the wage gap and fertility rate arguments. Beginning with the fixed effects results, the strongly negative effect of the lagged minimum wage on employment is again reported although it is smaller in absolute value than in the OLS estimates (but larger than reported in Table 3). The own effects of employment protection, union density, and the UI replacement rate are all negative but with the exception of the latter not statistically significant, while the directional influence of the basic variables is again confirmed. (Note that little reliance can be placed on the dummy bargained minimum wage variable in the fixed effects specification since it is solely identified by the British innovation, and is necessarily unidentified in the GMM estimation. Note too that the labor standards index drops out as it is time invariant measure.)

The interactions of the minimum wage argument with the wage gap, fertility, and the labor market institutions/policies are also of interest and – abstracting from youth subminima and subnational minima and labor standards – are opposite in sign from the own effects (with the exception of active labor market policies that are always favorable). The wage gap has a negative effect on net if the minimum ratio is greater than 0.45, while that of fertility is negative once that ratio falls below 0.46. The effect on female employment of a bargained minimum wage is always negative since the tipping-point value for the minimum wage rate of 0.06 is always exceeded in our data. Employment protection has a negative influence on net as long as the minimum wage ratio is less than 0.51, unemployment insurance has a negative effect where the wage ratio is less than 0.64, and union density where the ratio is less than 0.68. As before, excluding the wage gap and fertility variables (see the third column of Table 4) leaves the pattern of coefficient estimates unaffected. The coefficient estimate on the key lagged minimum wage variable increases in absolute value but the change is insufficient for us to downplay the hypothesized role of the wage gap and fertility arguments.

Our preferred GMM estimates in the sixth column of the table are even sharper. Thus, the own effect of higher fertility rates is now statistically significant as is the negative own effect of employment protection. Also the interaction terms are generally better determined. Cases in point include employment protection, youth and national subminima, and labor standards. The effect of higher labor standards and union density are always negative on net, though the latter coefficient estimates are not statistically significant. Positive interaction effects for fertility, employment protection, unemployment insurance, and active labor market policies are nevertheless consistent with negative



employment effects on net if the minimum wage ratio is less than 0.71, 0.53, 0.55, and 0.41 respectively. Much as before the positive own wage effect associated with the wage gap argument is consistent with a negative net effect once the minimum wage exceeds 0.50. The seeming detriment of a bargained minimum wage is underscored (see Bertola et al., 2007), even if the presence of different wage floors by industry and region seems to reduce the sting of minimum wages. Excluding the wage gap and fertility arguments (in the fifth column) leaves the key lagged minimum wage coefficient virtually unaffected as well as the minimum wage elasticity. Finally, we see that the latter is considerably larger in absolute terms than earlier reported for the more parsimonious regression in Table 3 that contains no information on the minimum wage fixing machinery and other labor market institutions.

In Appendix Tables 4 and 5 we provide employment results for the sample less the Nordic group and for a sample including the Nordic countries but with revised data for Sweden, respectively. Other than for the OLS results, it is clear that removing the Nordic group entirely produces only modest changes. For the fixed effect estimates the new coefficient estimates are somewhat smaller in absolute terms – including the key lagged minimum wage coefficient which is also less precisely estimated than before – but there are no changes in sign and significant variables generally remain so. More importantly, the GMM results are closer still in all respects, including the magnitude of the key lagged minimum wage regressor. As for the estimates with revised data for Sweden shown in Appendix Table 5, the results are again very close. Focusing on just the GMM results for the average minimum-to-median wage ratio, there is close correspondence between the point estimates of the lagged minimum wage variable and the minimum

wage elasticities with their counterparts in Table 4. Although there are no changes in sign for this sample, the employment protection and fertility arguments (and the interaction of the former with the minimum wage ratio) are not statistically significant. The labor standards interaction term is likewise statistically insignificant. That said, the two sets of estimates for this preferred specification are again very close, so that there does not appear to be a material data issue here.

Returning to results for the main sample, the last seven columns of Table 4 present results for labor force participation. It is striking that the impact of minimum wages on this outcome indicator is much more pronounced than in the parsimonious model of Table 3. The lagged minimum wage term is now considerably stronger and better determined than before and the minimum wage participation elasticities correspondingly greater in absolute terms. The results therefore also more closely parallel the results for employment. Focusing on the GMM results in the final column of the table, we see that in conjunction with the minimum wage argument the wage gap, bargained minima and labor standards have a negative effect on participation rates (the tipping point for the first argument is 0.45). For their part, the interaction effects of youth subminima and subnational minima are both positive. And although the interaction effects of employment protection, unemployment insurance, and active labor market policies are positive, the net effect of these variables on participation is negative if the wage ratio is greater than 0.54, 0.47, and 0.04, respectively. The own and interaction effects of unions are negative and hence reinforcing although neither coefficient estimate is statistically significant.

Finally, results for unemployment are given in Appendix Table 6. For the preferred GMM measure, the lagged minimum wage argument is weakly significant but few other arguments achieve significance. Those that do are quite consistent (i.e. opposite in sign) with the employment results. Cases in point include the positively signed coefficient estimates for the adult male unemployment rate, employment protection, and the unemployment insurance replacement rate variables, and the bargained minimum wage term, and the negative coefficient estimate for the subnational minimum wage. Excluding the wage gap and fertility rate arguments on grounds of their potential endogeneity inflates the point estimate for lagged minimum wages more substantially than for the other outcome indicators but does not greatly affect the other coefficient estimates. The more important bottom line, however, would be that the unemployment results are altogether less coherent than the employment findings. The reason is to be found in the (improved) participation rate findings.

**Table 5. Minimum Wage Elasticity of Labor Market Indicators**

Country	Average Minimum Wage Elasticity (Standard Deviation)					
	Employment		Labor Force Participation Rate (LFPR)		Unemployment	
Australia	-0.231 ***	(0.017)	-0.184 ***	(0.015)	0.052 ***	(0.003)
Belgium	-0.191 ***	(0.021)	-0.104 ***	(0.022)	0.111 ***	(0.008)
Canada	-0.185 ***	(0.017)	-0.145 ***	(0.018)	0.048 ***	(0.002)
France	-0.223 ***	(0.071)	-0.174 ***	(0.059)	0.049 ***	(0.013)
Germany	-0.380 ***	(0.013)	-0.329 ***	(0.013)	0.094 ***	(0.003)
Ireland	-0.050 ***	(0.021)	-0.024	(0.018)	0.032 ***	(0.004)
Italy	-0.515 ***	(0.032)	-0.404 ***	(0.025)	0.117 ***	(0.004)
Japan	-0.240 ***	(0.004)	-0.188 ***	(0.003)	0.047 ***	(0.002)
The Netherlands	-0.043 ***	(0.018)	-0.050 ***	(0.013)	-0.003	(0.009)
New Zealand	-0.188 ***	(0.026)	-0.149 ***	(0.022)	0.043 ***	(0.008)
Spain	-0.142 ***	(0.016)	-0.107 ***	(0.014)	0.023 ***	(0.004)
Sweden	-0.180 ***	(0.051)	-0.175 ***	(0.043)	0.018	(0.015)
United Kingdom	-0.186 ***	(0.016)	-0.108 ***	(0.018)	0.085 ***	(0.017)
United States	-0.194 ***	(0.012)	-0.142 ***	(0.010)	0.059 ***	(0.002)

*Notes:* The minimum wage effects for each country are based on the indicated specifications in columns (3), (6) of Table 4 and column (3) of Appendix Table 6. Employment, participation and unemployment elasticities are computed for each year as the coefficient on the minimum wage variable plus each of the coefficients on the interaction terms multiplied by the minimum wage setting dummies and the standardized values of the fertility rate, wage gap, and policy variables for each country. Averages of these elasticities across years are then calculated. Values for Finland and Denmark are not in this table since they are not included in the GMM regression due to lack of sufficient observations.

\*Statistically significant at the .10 level, \*\* at the .05 level, \*\*\* at the .01 level.

As a final exercise, we investigate differences in minimum wage effects across countries. First, the individual country minimum wage elasticities are reported in Table 5. The estimates in question are based on the GMM specifications given in the sixth and twelfth columns of Table 4 (and the sixth column of [Appendix Table 6](#) in the case of the unemployment outcome indicator) are averages of the annual values for each country.<sup>15</sup> We also calculated individual country minimum wage elasticities without controls for the wage gap and fertility, and without the Nordic countries (just Sweden in this case) and with separate minimum wage ratios for Sweden. The results generally follow the pattern of Table 5 and are available from the authors upon request.

The minimum wage elasticities with respect to employment range from -0.043 in the case of The Netherlands to -0.515 for Italy. The corresponding range for the minimum wage participation elasticity – which with the exception of one country exceed the former elasticities in absolute terms – range from -0.024 (for Ireland) to -0.404 (Italy). These results imply material disemployment effects. But the effects of minimum wages on this labor market segment are not confined to employment and participation. As shown in the final column of the table, minimum wage unemployment elasticities are (with one exception) also positive and in almost all cases statistically significant as well. To be sure, these latter elasticities are smaller, but the shake out of female labor from higher minimum wages evidently also feeds through into unemployment.

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<sup>15</sup> We also estimated the corresponding minimum wage elasticities for the fixed effect specifications given in the fourth, and tenth columns of Table 4 (and the fourth column of Appendix Table 6). In each case the elasticities were somewhat larger, and all were well determined. The results are available from the authors upon request.

Table 6. Elasticities across Labor Market Characteristics

		low employment protection/low active labor market policies				high employment protection/high active labor market policies			
low labor standards	<i>Canada</i>	e_emp	-0.185	<i>United Kingdom</i>	e_emp	-0.186	<i>Belgium</i>	e_emp	-0.191
	(13,14)	e_unemp	0.048	(15, 14)	e_unemp	0.085	(10,4)	e_unemp	0.111
		e_lfpr	-0.145		e_lfpr	-0.108		e_lfpr	-0.104
	<i>Ireland</i>	e_emp	-0.050	<i>United States</i>	e_emp	-0.194			
	(10,10)	e_unemp	0.032	(15,16)	e_unemp	0.059			
		e_lfpr	-0.024		e_lfpr	-0.142			
	<i>Japan</i>	e_emp	-0.240						
	(13,12)	e_unemp	0.047						
		e_lfpr	-0.188						
high labor standards	<i>Australia</i>	e_emp	-0.231				<i>Sweden</i>	e_emp	-0.180
	(4,13)	e_unemp	0.052				(1,1)	e_unemp	0.018
		e_lfpr	-0.184					e_lfpr	-0.175
	<i>New Zealand</i>	e_emp	-0.188				<i>France</i>	e_emp	-0.223
	(4,11)	e_unemp	0.043				(4,7)	e_unemp	0.049
		e_lfpr	-0.149					e_lfpr	-0.174
	<i>Spain</i>	e_emp	-0.142				<i>Germany</i>	e_emp	-0.380
	(4, 9)	e_unemp	0.023				(2,1)	e_unemp	0.094
		e_lfpr	-0.107					e_lfpr	-0.329

Notes: Joint rankings are created as the ranking of the sum of employment protection and active labor market policy rankings. The first ranking in parenthesis is for labor standards and the second ranking is for this joint measure. These ranking are based on average policy values for each country, not the yearly values. Values for Finland and Denmark are missing because they are not included in GMM regression due to lack of sufficient observations.

**Table 7 . Elasticities across Labor Market Policies and Social Characteristics**

			low labor standards		high labor standards	
			low wage gap	high wage gap	low wage gap	high wage gap
low employment protection	low fertility	e_emp	-0.144	-0.207	-0.224	
		e_unemp	0.051	0.061	0.051	
		e_lfpr	-0.096	-0.154	-0.177	
	high fertility	e_emp	-0.127	-0.193	-0.191	-0.227
		e_unemp	0.048	0.059	0.043	0.052
		e_lfpr	-0.083	-0.140	-0.152	-0.185
high employment protection	low fertility	e_emp	-0.191	-0.240	-0.197	-0.181
		e_unemp	0.111	0.046	0.039	0.034
		e_lfpr	-0.104	-0.188	-0.162	-0.160
	high fertility	e_emp			-0.168	<b>-0.342</b>
		e_unemp			0.025	<b>0.071</b>
		e_lfpr			-0.149	<b>-0.275</b>

*Notes:* In this table high and low classifications for each labor market policy or social characteristic is based on yearly values, not a unique value for each country across years but unique to each country and each year given the values for these characteristics. Thus, elasticities for one country for different years can be averaged in different cells. Values for Finland and Denmark are missing because they are not included in GMM regression due to lack of sufficient observations.

The next issue concerns combinations of policies. As we have seen, Neumark and Wascher (2004: 242-3) were able to detect certain patterns in the data; most notable of which was their finding that the disemployment effects of minimum wages were strongest in those countries (Canada, Japan, the United States, and the United Kingdom) with the least regulated markets. In our framework of time-varying regressors, identification of individual countries with set regimes is not straightforward. We first followed Neumark and Wascher's methodology and grouped our countries with respect to degree of market regulation using an average value for the policy indicators and by creating a joint ranking for employment protection and active labor market policies. As is evident from Table 6, which includes unemployment elasticities in addition to employment and participation elasticities, we cannot replicate their results for prime-age females. Indeed, if anything, the suggestion is the least regulated markets produce the best outcomes for women.

However, it is manifestly the case that the patterns are by no means consistent for all countries in these groups, pointing to the role of other factors in explaining the differences. Moreover, with our time-varying regressors, countries move in their rankings over the years, making it hard to characterize countries as populating a unique cluster. In Table 7, therefore, we allow each country to be classified by its yearly status by policy dimension.<sup>16</sup> We can see from this table that in highly regulated countries, especially in circumstances where the wage gap is high (where women are less productive or concentrated in low-paying industries), and where fertility rates are also high (implying lesser job experience), minimum wages seem to have the highest collateral damage to female employment and participation. In short, policy parameters alone cannot explain elasticities.

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<sup>16</sup> 16. Observe that for both Tables 6 and 7 our country data conform to those used in Tables 3 and 4 (for employment and participation rates, respectively) and Appendix Table 6 (for unemployment rates) and, being based on the GMM estimates, exclude Finland and Denmark.



ties in a cohesive manner. Other country characteristics play a more crucial role in explaining female labor market activity.

The bottom line is that despite the results of our regression analysis sharing a key commonality with the study of Neumark and Wascher, there is little evidence of similar patterns of elasticities in our data. This is not unexpected given the time-varying nature of our regressors and the different demographic group studied.

## **6. Concluding Remarks**

The present exercise is one of only a handful of studies to have investigated the sensitivity of female employment to the minimum wage, and almost the only one to exploit a cross-nation panel. Our study was motivated by Neumark and Wascher's seminal study of the sensitivity of teenage and youth unemployment to minimum wages, the innovation here residing in their analysis of a cross-country panel than the target group selected. In this regard, we were also struck by the authors' caveat that, by using the adult minimum wage in constructing the minimum wage ratio, they had "overstated the relevant (or 'effective') minimum wage for the age groups under study ..." (Hence their use of a youth subminimum in their first set of extended regressions.). In our study, use of the adult minimum wage raises no such difficulties of interpretation; although our understanding of minimum wage effects is enhanced by the inclusion of a gender wage gap argument, offering insights into the bite of minimum wages even after taking the potential endogeneity of the variable into account. And indeed we found consistent evidence that increases in minimum wages translated into lower female employment and participation rates. The results for unemployment were somewhat less transparent, pre-

sumably because of labor market withdrawal. On the other hand, we were frankly surprised by the failure of the presence of youth subminima to strengthen the minimum wage effect, although one possibility might be that the youth discount may vary inversely with the magnitude of the minimum wage. Future research might usefully examine this relation and also whether the effect might reflect complementarities between youth and particular age groups within the female labor force. Another issue concerns the seemingly unfavorable effect of bargained wage minima. This might reflect a familiar union effect not otherwise really discernible in the union indicator deployed here.

There were also some interesting commonalities between ourselves and Neumark and Wascher having to do with the interaction of labor standards and employment protection with minimum wages. That said, our data for adult females do not permit such a tidy configuration of nations as reported by Neumark and Wascher for youths and teenagers of both genders. We do not find any obvious alignment of labor market institutions and policies. Indeed, the institutional patterns we detect are if anything the reverse of those reported by Neumark and Wascher.

Yet the more fundamental agreement was the finding of consistent disemployment effects for the target group examined. Our preferred estimates of the elasticity of the adult female employment-to-population ratio with respect to the minimum wage ranged from -0.056 to -0.463 in the basic model and from -0.194 to -0.981 in the augmented model. These are not trivial values for developed nations.

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**Appendix Table 1. Estimates of the Standard Minimum Wage Model Using International Data, Excluding Nordic Countries**

Variable	Adult Female Employment-to-Population Ratio		
	OLS	FE	GMM
Lagged Adult Female Employment			0.637*** [0.067]
Lagged Min-to-Median Wage Ratio	-0.228*** [0.055]	-0.135*** [0.032]	-0.079*** [0.012]
Adult Male Unemployment Rate	-0.394*** [0.147]	-0.544*** [0.103]	-0.352*** [0.046]
Wage Gap	-0.034** [0.017]	0.070*** [0.016]	0.020** [0.009]
Fertility Rate	-0.395*** [0.079]	0.015 [0.039]	0.012 [0.020]
<i>Lagged Minimum-to-Median Wage Ratio interacted with:</i>			
Wage Gap	0.028 [0.039]	-0.150*** [0.034]	-0.039** [0.020]
Fertility Rate	1.150*** [0.148]	0.054 [0.096]	-0.012 [0.049]
Constant	0.515*** [0.031]	0.397*** [0.023]	0.180*** [0.024]
Minimum Wage Elasticity	-0.398*** [0.189]	-0.132*** [0.062]	-0.074*** [0.016]
Country Fixed Effects	NO	YES	YES
Year Fixed Effects	YES	YES	YES
Country Specific Time Trends	YES	YES	YES
Observations	319	319	291
R-squared	0.919	0.987	
Number of Countries		16	14
Hausman / Sargan tests (p-values)	0.000	0.000	-
Notes: See Notes for Table 3 in the main text.			
*Statistically significant at the .10 level, ** at the .05 level, *** at the .01 level.			

**Appendix Table 2. Estimates of the Standard Minimum Wage Model of Employment Using International Data, Including Nordic Countries with Revised Data for Sweden**

Variable	Average Minimum-to-Mean Wage Ratio			Retail Minimum-to-Mean Wage Ratio			Hotels/Restaurants Minimum-to-Mean Wage Ratio			Food/Bakery Minimum-to-Mean Wage Ratio		
	OLS	FE	GMM	OLS	FE	GMM	OLS	FE	GMM	OLS	FE	GMM
Lagged Adult Female Employment			0.676*** [0.071]			0.672*** [0.069]			0.643*** [0.069]			0.672*** [0.068]
Lagged Min-to-Median Wage Ratio	-0.151* [0.086]	-0.119*** [0.033]	-0.070*** [0.017]	-0.011 [0.094]	-0.146*** [0.036]	-0.078*** [0.015]	-0.072 [0.084]	-0.153*** [0.046]	-0.078*** [0.014]	-0.246*** [0.090]	-0.131*** [0.034]	-0.080*** [0.015]
Adult Male Unemployment Rate	-0.667*** [0.194]	-0.627*** [0.121]	-0.371*** [0.051]	-0.660*** [0.185]	-0.615*** [0.119]	-0.367*** [0.051]	-0.644*** [0.189]	-0.611*** [0.117]	-0.357*** [0.048]	-0.658*** [0.194]	-0.624*** [0.121]	-0.367*** [0.051]
Wage Gap	0.093*** [0.028]	0.073*** [0.015]	0.018** [0.008]	0.125*** [0.030]	0.063*** [0.015]	0.015** [0.007]	0.111*** [0.028]	0.062*** [0.016]	0.021*** [0.007]	0.076*** [0.028]	0.069*** [0.015]	0.015** [0.008]
Fertility Rate	0.038 [0.098]	0.05 [0.029]	0.020* [0.011]	0.175* [0.090]	0.032 [0.025]	0.011 [0.011]	0.152 [0.092]	0.037 [0.027]	0.019 [0.013]	0.154* [0.093]	0.055* [0.030]	0.016 [0.011]
<i>Lagged Minimum-to-Median Wage Ratio interacted with:</i>												
Wage Gap	-0.263*** [0.070]	-0.159*** [0.031]	-0.037** [0.015]	-0.302*** [0.070]	-0.138*** [0.030]	-0.031** [0.014]	-0.276*** [0.068]	-0.133*** [0.033]	-0.041*** [0.014]	-0.219*** [0.069]	-0.149*** [0.031]	-0.031* [0.016]
Fertility Rate	0.102 [0.192]	-0.031 [0.060]	-0.037 [0.029]	-0.095 [0.171]	0.011 [0.044]	-0.015 [0.026]	-0.057 [0.176]	0.002 [0.056]	-0.031 [0.030]	-0.127 [0.177]	-0.037 [0.058]	-0.026 [0.028]
Constant	0.491*** [0.042]	0.409*** [0.026]	0.170*** [0.025]	0.382*** [0.045]	0.426*** [0.027]	0.178*** [0.024]	0.414*** [0.041]	0.426*** [0.032]	0.183*** [0.025]	0.513*** [0.045]	0.413*** [0.026]	0.177*** [0.023]
Minimum Wage Elasticity	-0.142 [0.109]	-0.100 [0.064]	-0.061*** [0.016]	0.032 [0.123]	-0.134*** [0.056]	-0.073*** [0.013]	-0.037 [0.112]	-0.141*** [0.054]	-0.069*** [0.017]	-0.207*** [0.089]	-0.111* [0.060]	-0.073*** [0.013]
Country Fixed Effects	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
Year Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country Specific Time Trends	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	339	339	307	339	339	307	337	337	305	339	339	307
R-squared	0.848	0.985		0.85	0.985		0.855	0.986		0.849	0.985	
Number of Countries		16	14		16	14		16	14		16	14
Hausman / Sargan tests (p-values)	0.000	0.000	-	0.000	0.000	-	0.000	0.000	-	0.000	0.000	-

*Notes:* See notes for Table 3 in the main text. The minimum-to-mean wage ratios shown are from Skedinger (2010) and pertain to 20 year-old unskilled blue-collar workers with no experience. The values in the first column are averages across six sectors comprising engineering, construction, and slaughter houses in addition to those shown in the next three columns.

\*Statistically significant at the .10 level, \*\* at the .05 level, \*\*\* at the .01 level.



**Appendix Table 3. Estimates of the Standard Minimum Wage Model Using International Data for the Unemployment Outcome**

<i>Variable</i>	OLS			FE		GMM	
Lagged Adult Female Unemployment						0.691*** [0.075]	0.663*** [0.088]
Lagged Minimum-to-Median Wage Ratio	-0.005 [0.015]	-0.025 [0.023]	0.033 [0.024]	0.034 [0.048]	0.033 [0.036]	0.046*** [0.015]	0.046*** [0.015]
Adult Male Unemployment Rate	1.029*** [0.084]	0.745*** [0.080]	0.822*** [0.092]	0.732*** [0.081]	0.704*** [0.076]	0.388*** [0.070]	0.395*** [0.075]
Wage Gap	0.021*** [0.005]	-0.008 [0.008]			-0.020* [0.010]		-0.011 [0.007]
Fertility Rate	0.027* [0.014]	-0.130*** [0.038]			-0.030 [0.044]		-0.019* [0.011]
<i>Lagged Minimum-to-Median Wage Ratio interacted with:</i>							
Wage Gap	-0.054*** [0.013]	0.015 [0.017]			0.044* [0.024]		0.017 [0.014]
Fertility Rate	-0.151*** [0.025]	0.126* [0.072]			-0.023 [0.079]		0.017 [0.029]
Constant	0.000 [0.008]	0.093*** [0.015]	0.005 [0.010]	0.01 [0.024]	0.039** [0.018]	-0.021** [0.009]	-0.008 [0.012]
Minimum Wage Elasticity	0.021 [0.031]	-0.044** [0.021]	0.033 [0.024]	0.034 [0.048]	0.032*** [0.018]	0.046*** [0.015]	0.042*** [0.007]
Country Fixed Effects	NO	NO	NO	YES	YES	YES	YES
Year Fixed Effects	NO	YES	YES	YES	YES	YES	YES
Country Specific Time Trends	NO	YES	YES	YES	YES	YES	YES
Observations	339	339	339	339	339	307	307
R-squared	0.697	0.88	0.847	0.863	0.881		
Number of Countries				16	16	14	14
Hausman / Sargan tests (p-values)	0.000	0.000	0.000	0.000	0.016	0.000	-

*Notes:* See Notes to Table 3 and Table 4

\*Statistically significant at the .10 level, \*\* at the .05 level, \*\*\* at the .01 level.

**Appendix Table 4. Estimates of the Augmented Minimum Wage Model with Characteristics of Minimum Wage Systems and Other Labor Market Policies and Institutions on Employment, Excluding Nordic Countries**

Variable	Adult Female Employment-to-Population Ratio		
	OLS	FE	GMM
Lagged Adult Female Employment			0.576*** [0.067]
Lagged Min to Median Wage Ratio	-0.607*** [0.117]	-0.279** [0.116]	-0.253*** [0.057]
Adult Male Unemployment Rate	-0.707*** [0.101]	-0.491*** [0.094]	-0.360*** [0.045]
Wage Gap	-0.010 [0.024]	0.059*** [0.018]	0.032*** [0.009]
Fertility Rate	0.065 [0.049]	-0.052 [0.046]	-0.040** [0.020]
Bargained Minimum Wage	0.427*** [0.061]	0.046 [0.153]	
Youth Subminimum	-0.401*** [0.078]		
Subnational Minimum	-0.348*** [0.081]		
Employment Protection Index	-0.084*** [0.026]	-0.068 [0.058]	-0.051* [0.027]
Union Density	0.001 [0.019]	-0.019 [0.021]	-0.007 [0.008]
Unemp. Insurance Replacement Rate	-0.020 [0.026]	-0.095** [0.034]	-0.104*** [0.026]
Active Labor Market Policies	0.010 [0.019]	-0.002 [0.016]	-0.021 [0.015]
Labor Standards Index	-0.043 [0.049]		

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<i>Lagged Minimum to Median Wage Ratio interacted with:</i>			
Wage Gap	-0.023 [0.052]	-0.125*** [0.040]	-0.062*** [0.020]
Fertility Rate	0.009 [0.096]	0.142 [0.118]	0.067 [0.045]
Bargained Minimum Wage	-0.640*** [0.118]	-0.496* [0.256]	-0.430** [0.209]
Youth Subminimum	0.489*** [0.140]	0.232 [0.136]	0.223*** [0.068]
Subnational Minimum	0.493*** [0.152]	0.381 [0.239]	0.347** [0.142]
Employment Protection Index	0.054 [0.051]	0.128 [0.103]	0.096* [0.049]
Union Density	-0.036 [0.036]	0.027 [0.033]	0.001 [0.015]
Unemp. Insurance Replacement Rate	-0.007 [0.045]	0.142** [0.062]	0.187*** [0.051]
Active Labor Market Policies	-0.013 [0.038]	0.019 [0.033]	0.048 [0.032]
Labor Standards Index	0.030 [0.081]	-0.102 [0.161]	-0.177* [0.103]
Constant	0.675*** [0.051]	0.340*** [0.052]	0.142** [0.063]
Minimum Wage Elasticity	-0.464 0.110	-0.210 0.097	-0.169 0.098
Country Fixed Effects	NO	YES	YES
Year Fixed Effects	YES	YES	YES
Country Specific Time Trends	YES	YES	YES
Observations	319	319	291
R-squared	0.981	0.99	
Number of Countries		13	13
Hausman / Sargan tests (p-values)			
Notes: See Notes to Table 4			
*Statistically significant at the .10 level, ** at the .05 level, *** at the .01 level.			

**Appendix Table 5. Estimates of the Augmented Minimum Wage Model with Characteristics of Minimum Wage Systems and Other Labor Market Policies and Institutions on Employment, Including Nordic Countries with Revised Data for Sweden**

Variable	Average Minimum-to-Mean Wage Ratio			Retail Minimum-to-Mean Wage Ratio			Hotels/Restaurants Minimum-to-Mean Wage Ratio			Food/Bakery Minimum-to-Mean Wage Ratio		
	OLS	FE	GMM	OLS	FE	GMM	OLS	FE	GMM	OLS	FE	GMM
Lagged Adult Female Employment			0.592*** [0.071]			0.588*** [0.070]			0.589*** [0.067]			0.590*** [0.071]
Lagged Min to Median Wage Ratio	1.634*** [0.159]	-0.382*** [0.126]	-0.338*** [0.080]	-1.397*** [0.125]	-0.333** [0.123]	-0.311*** [0.076]	-1.374*** [0.133]	-0.351** [0.123]	-0.323*** [0.081]	-1.641*** [0.162]	-0.369*** [0.129]	-0.310*** [0.076]
Adult Male Unemployment Rate	0.807*** [0.109]	-0.527*** [0.097]	-0.369*** [0.049]	-0.814*** [0.099]	-0.526*** [0.097]	-0.366*** [0.048]	-0.775*** [0.099]	-0.524*** [0.098]	-0.364*** [0.049]	-0.869*** [0.113]	-0.537*** [0.098]	-0.367*** [0.048]
Wage Gap	-0.005 [0.028]	0.057*** [0.019]	0.026*** [0.009]	0.002 [0.024]	0.056*** [0.016]	0.026*** [0.007]	-0.002 [0.023]	0.056*** [0.016]	0.024*** [0.008]	0.015 [0.027]	0.059*** [0.018]	0.026** [0.007]
Fertility Rate	-0.030 [0.056]	-0.014 [0.041]	-0.023 [0.017]	0.111*** [0.047]	-0.009 [0.039]	-0.022 [0.016]	0.070 [0.045]	-0.01 [0.039]	-0.027* [0.016]	0.020 [0.064]	0.016 [0.041]	-0.018 [0.016]
Bargained Minimum Wage	0.298*** [0.078]	-0.043 [0.044]		0.430*** [0.065]	0.026 [0.042]		0.434*** [0.064]	-0.011 [0.044]		0.312*** [0.085]	0.001 [0.044]	
Youth Subminimum	0.789*** [0.091]			-0.725*** [0.071]			-0.737*** [0.077]			-0.758*** [0.094]		
Subnational Minimum	0.686*** [0.094]			-0.688*** [0.071]			-0.721*** [0.068]			-0.633*** [0.108]		
Employment Protection Index	0.103*** [0.026]	-0.042 [0.047]	-0.028 [0.023]	-0.088*** [0.023]	-0.044 [0.038]	-0.027 [0.020]	-0.089*** [0.024]	-0.038 [0.040]	-0.026 [0.019]	-0.120*** [0.027]	-0.039 [0.040]	-0.024 [0.019]
Union Density	0.004 [0.022]	-0.026 [0.022]	-0.007 [0.009]	0.001 [0.019]	-0.025 [0.021]	-0.007	0.011 [0.019]	-0.025 [0.021]	-0.007 [0.009]	-0.003 [0.023]	-0.029 [0.023]	-0.007 [0.009]
Unemp. Insurance Replacement Rate	-0.014 [0.034]	-0.101** [0.037]	-0.087*** [0.019]	0.006 [0.027]	-0.108*** [0.035]	[0.009] [0.017]	0.013 [0.027]	-0.107** [0.037]	-0.087*** [0.022]	-0.015 [0.036]	-0.095** [0.036]	-0.087*** [0.019]
Active Labor Market Policies	0.010 [0.014]	0.005 [0.007]	0.001 [0.003]	-0.003 [0.010]	0.009 [0.006]	0.003 [0.003]	-0.017* [0.010]	0.008 [0.006]	0.004 [0.004]	0.016 [0.013]	0.008 [0.006]	0.003 [0.003]
Labor Standards Index	0.035 [0.064]			-0.054 [0.043]			-0.087** [0.044]			0.095 [0.071]		

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*Lagged Minimum to Median Wage Ratio interacted with:*

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Wage Gap	-0.078	-0.119**	-0.050**	-0.069	-0.117***	-0.048***	-0.059	-0.116***	-0.045***	-0.128**	-0.124***	-0.049***
	[0.058]	[0.042]	[0.021]	[0.050]	[0.035]	[0.016]	[0.049]	[0.036]	[0.017]	[0.054]	[0.040]	[0.017]
Fertility Rate	0.0980	0.040	0.0230	-0.159*	0.0350	0.0260	-0.0360	0.0360	0.0350	-0.0460	-0.020	0.0170
	[0.098]	[0.104]	[0.038]	[0.091]	[0.099]	[0.036]	[0.089]	[0.098]	[0.037]	[0.112]	[0.100]	[0.037]
Bargained Minimum Wage	0.461***	-0.393**	-0.273***	-0.663***	-0.454***	-0.292***	-0.659***	-0.405**	-0.263***	-0.517***	-0.447**	-0.293**
	[0.138]	[0.163]	[0.103]	[0.116]	[0.151]	[0.099]	[0.117]	[0.155]	[0.099]	[0.147]	[0.157]	[0.098]
Youth Subminimum	1.414***	0.310*	0.277***	1.199***	0.265	0.252**	1.208***	0.275	0.262***	1.374***	0.300	0.247**
	[0.175]	[0.167]	[0.102]	[0.139]	[0.163]	[0.099]	[0.145]	[0.165]	[0.098]	[0.177]	[0.178]	[0.098]
Subnational Minimum	1.480***	0.520***	0.431***	1.312***	0.400***	0.366***	1.356***	0.450***	0.399***	1.411***	0.455***	0.362***
	[0.159]	[0.130]	[0.072]	[0.130]	[0.126]	[0.069]	[0.129]	[0.127]	[0.086]	[0.178]	[0.138]	[0.071]
Employment Protection Index	0.076	0.072	0.046	0.045	0.078	0.044	0.055	0.067	0.042	0.100*	0.070	0.040
	[0.051]	[0.077]	[0.040]	[0.046]	[0.059]	[0.034]	[0.048]	[0.062]	[0.030]	[0.054]	[0.063]	[0.030]
Union Density	-0.039	0.040	0.002	-0.038	0.038	0.001	-0.060*	0.039	0.000	-0.023	0.044	0.001
	[0.038]	[0.035]	[0.016]	[0.033]	[0.034]	[0.016]	[0.033]	[0.034]	[0.017]	[0.040]	[0.037]	[0.017]
Unemp. Insurance Replacement Rate	-0.027	0.155**	0.153***	-0.050	0.166**	0.151***	-0.059	0.164**	0.153***	-0.027	0.144*	0.152***
	[0.061]	[0.069]	[0.037]	[0.050]	[0.064]	[0.033]	[0.049]	[0.067]	[0.044]	[0.064]	[0.068]	[0.036]
Active Labor Market Policies	0.001	0.003	0.003	0.019	-0.004	-0.001	0.045***	-0.002	-0.002	-0.010	-0.001	0.000
	[0.021]	[0.010]	[0.003]	[0.015]	[0.009]	[0.003]	[0.016]	[0.009]	[0.011]	[0.019]	[0.008]	[0.003]
Labor Standards Index	-0.033	-0.012	-0.071	0.077	-0.063	-0.088**	0.126*	-0.033	-0.073*	-0.130	-0.029	-0.087**
	[0.100]	[0.090]	[0.043]	[0.070]	[0.081]	[0.035]	[0.072]	[0.085]	[0.038]	[0.110]	[0.080]	[0.035]
Constant	1.136***	0.373***	0.154***	1.020***	0.382***	0.169***	1.006***	0.376***	0.159***	1.142***	0.381***	0.169***
	[0.070]	[0.041]	[0.049]	[0.056]	[0.035]	[0.051]	[0.059]	[0.038]	[0.045]	[0.071]	[0.038]	[0.049]
Minimum Wage Elasticity	1.002***	-0.233**	-0.199***	-0.843***	-0.228***	-0.194***	-0.833**	-0.227***	-0.194***	-1.009***	-0.235***	-0.194***
	[0.376]	[0.111]	[0.079]	[0.370]	[0.101]	[0.074]	[0.396]	[0.104]	[0.077]	[0.349]	[0.104]	[0.074]
Country Fixed Effects	NO	YES	YES	NO	YES	YES	NO	YES	YES	NO	YES	YES
Year Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country Specific Time Trends	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	339	339	307	339	339	307	337	337	305	339	339	307
R-squared	0.976	0.99		0.98	0.99		0.981	0.99		0.975	0.989	
Number of Countries		16	14		16	14		16	14		16	14
Hausman / Sargan tests (p-values)	0.000	0.000	-	0.000	0.000	-	0.000	0.000	-	0.000	0.000	-

*Notes:* See Notes to Table 4. The minimum-to-mean wage ratios shown are from Skedinger (2010) and pertain to 20 year-old unskilled blue-collar workers with no experience. The values in the first column are averages across six sectors comprising engineering, construction, and slaughter houses in addition to those shown in the next three columns.

\*Statistically significant at the .10 level, \*\* at the .05 level, \*\*\* at the .01 level.

**Appendix Table 6. Estimates of the Augmented Minimum Wage Model with Characteristics of Minimum Wage Systems and Other Labor Market Policies and Institutions for the Unemployment Outcome**

Variable	OLS		FE		GMM	
Lagged Adult Female Unemployment					0.580***	0.571***
					[0.064]	[0.067]
Lagged Min-to-Median Wage Ratio	-0.009	0.054	0.015	-0.055	0.118***	0.073*
	[0.091]	[0.072]	[0.114]	[0.087]	[0.049]	[0.040]
Adult Male Unemployment Rate	0.860***	0.812***	0.659***	0.637***	0.416***	0.412***
	[0.093]	[0.077]	[0.089]	[0.086]	[0.074]	[0.071]
Wage Gap		0.058***		0.010		-0.007
		[0.015]		[0.022]		[0.009]
Fertility Rate		-0.104***		0.012		0.005
		[0.029]		[0.035]		[0.016]
Bargained Minimum Wage	-0.211***	-0.115***	-0.064	-0.076		
	[0.039]	[0.035]	[0.061]	[0.062]		
Youth Subminimum	0.087	0.100**				
	[0.062]	[0.050]				
Subnational Minimum	0.132***	0.049				
	[0.051]	[0.045]				
Employment Protection Index	0.048***	0.046***	0.049	0.051	0.026**	0.026*
	[0.017]	[0.018]	[0.045]	[0.053]	[0.013]	[0.015]
Union Density	0.020**	0.034***	0.041*	0.032	0.012	0.006
	[0.011]	[0.012]	[0.023]	[0.020]	[0.009]	[0.009]
Unemp. Insurance Replacement Rate	0.126***	0.076***	0.037	0.041	0.019	0.029***
	[0.021]	[0.017]	[0.030]	[0.025]	[0.014]	[0.009]
Active Labor Market Policies	-0.017	-0.024***	-0.017	-0.014	0.001	0.003
	[0.014]	[0.011]	[0.010]	[0.009]	[0.007]	[0.007]
Labor Standards Index	0.046*	0.060***				
	[0.024]	[0.021]				

*continues on the next page*

<i>Lagged Minimum to Median Wage Ratio interacted with:</i>				<i>continues from the previous page</i>		
Wage Gap	-0.109***			-0.028		0.006
	[0.032]			[0.048]		[0.020]
Fertility Rate	0.101**			-0.069		-0.022
	[0.060]			[0.071]		[0.031]
Bargained Minimum Wage	0.359***	0.265***	0.305*	0.265	0.230***	0.207**
	[0.079]	[0.072]	[0.158]	[0.181]	[0.080]	[0.084]
Youth Subminimum	-0.086	-0.186*	-0.133	-0.076	-0.137*	-0.086
	[0.112]	[0.095]	[0.126]	[0.109]	[0.073]	[0.061]
Subnational Minimum	-0.229**	-0.164*	-0.176	-0.104	-0.164***	-0.142***
	[0.107]	[0.095]	[0.125]	[0.142]	[0.051]	[0.052]
Employment Protection Index	-0.033	-0.062*	-0.079	-0.094	-0.042+	-0.045
	[0.030]	[0.033]	[0.090]	[0.103]	[0.024]	[0.028]
Union Density	-0.01	-0.038	-0.063	-0.046	-0.012	-0.001
	[0.024]	[0.023]	[0.044]	[0.040]	[0.018]	[0.018]
Unemp. Insurance Replacement Rate	-0.181***	-0.096***	-0.001	-0.007	-0.007	-0.023
	[0.037]	[0.030]	[0.071]	[0.062]	[0.032]	[0.024]
Active Labor Market Policies	0.026	0.042**	0.023	0.02	-0.006	-0.009
	[0.027]	[0.021]	[0.020]	[0.020]	[0.014]	[0.014]
Labor Standards Index	-0.165***	-0.170***	-0.078	-0.073	-0.001	0.003
	[0.042]	[0.037]	[0.085]	[0.098]	[0.036]	[0.036]
Constant	0.054	0.066**	0.097**	0.116**	0.014	0.027
	[0.040]	[0.030]	[0.037]	[0.045]	[0.015]	[0.018]
Minimum Wage Elasticity	-0.030	0.011	-0.004	-0.039	0.080	0.051
	0.140	0.123	0.060	0.060	0.035	0.032
Country Fixed Effects	NO	NO	YES	YES	YES	YES
Year Fixed Effects	YES	YES	YES	YES	YES	YES
Country Specific Time Trends	YES	YES	YES	YES	YES	YES
Observations	339	339	339	339	307	307
R-squared	0.935	0.951	0.919	0.923		
Number of Countries			16	16	14	14
Hausman / Sargan tests (p-values)	0.000		0.001			--
<i>Notes:</i> See Notes to Table 3 and Table 4						
*Statistically significant at the .10 level, ** at the .05 level, *** at the .01 level.						





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